What is claimed is:

1. A semiconductor device, comprising:

a wide bandgap semiconductor layer having an array of discontinuous wide bandgap semiconductor regions therein that contribute to a reduction in ionization energies of dopants in said wide bandgap semiconductor layer relative to an otherwise equivalent wide bandgap semiconductor layer that is devoid of the array of discontinuous wide bandgap semiconductor regions.

2. The device of Claim 1, wherein the array of discontinuous wide bandgap semiconductor regions is a three-dimensional array.

3. The device of Claim 1, wherein said wide bandgap semiconductor layer has a plurality of two-dimensional arrays of discontinuous wide bandgap semiconductor regions therein that are parallel to each other.

4. The device of Claim 1, wherein the discontinuous wide bandgap semiconductor regions in the array are nonuniformly spaced from each other.

5. The device of Claim 1, wherein the discontinuous wide bandgap semiconductor regions in the array have nonuniform sizes and shapes.

6. The device of Claim 1, wherein said wide bandgap semiconductor layer has a plurality of two-dimensional regular arrays of discontinuous wide bandgap semiconductor regions therein that are parallel to each other.

7. The device of Claim 6, wherein the plurality of two-dimensional regular arrays of discontinuous wide bandgap semiconductor regions are staggered relative to each other.

8. The device of Claim 1, wherein said wide bandgap semiconductor layer and the wide bandgap semiconductor regions are of net first conductivity type; and wherein the wide bandgap semiconductor regions are more highly doped with first conductivity type dopants relative to said wide bandgap semiconductor layer.

9 A semiconductor device, comprising:

a wide bandgap semiconductor layer having an array of discontinuous wide bandgap semiconductor regions therein that have a wider bandgap relative to said wide bandgap semiconductor layer.

10. The device of Claim 9, wherein the array of discontinuous wide bandgap semiconductor regions is a three-dimensional array.

11. The device of Claim 9, wherein said wide bandgap semiconductor layer has a plurality of two-dimensional arrays of discontinuous wide bandgap semiconductor regions therein that are parallel to each other.

12. The device of Claim 9, wherein the discontinuous wide bandgap semiconductor regions in the array are nonuniformly spaced from each other.

13. The device of Claim 9, wherein the discontinuous wide bandgap semiconductor regions in the array have nonuniform sizes and shapes.

14. The device of Claim 9, wherein said wide bandgap semiconductor layer has a plurality of two-dimensional regular arrays of discontinuous wide bandgap semiconductor regions therein that are parallel to each other.

15. The device of Claim 14, wherein the plurality of two-dimensional regular arrays of discontinuous wide bandgap semiconductor regions are staggered relative to each other.

16. The device of Claim 9, wherein said wide bandgap semiconductor layer and the wide bandgap semiconductor regions are of net first conductivity type; and wherein the wide bandgap semiconductor regions are more highly doped with first conductivity type dopants relative to said wide bandgap semiconductor layer.

17. A semiconductor device, comprising:

a Group III nitride layer comprising an array of discontinuous Group III nitride regions therein that have a wider bandgap relative to said Group III nitride layer.

18. The device of Claim 17, wherein the array of discontinuous Group III nitride regions is a three-dimensional array.

19. The device of Claim 17, wherein said Group III nitride layer has a plurality of two-dimensional arrays of discontinuous Group III nitride regions therein that are parallel to each other.

20. The device of Claim 17, wherein the discontinuous Group III nitride regions in the array are nonuniformly spaced from each other.

21. The device of Claim 17, wherein the discontinuous Group III nitride regions in the array have nonuniform sizes and shapes.

22. The device of Claim 17, wherein said Group III nitride layer has a plurality of two-dimensional regular arrays of discontinuous Group III nitride regions therein that are parallel to each other.

23. The device of Claim 22, wherein the plurality of two-dimensional regular arrays of discontinuous Group III nitride regions are staggered relative to each other.

24. The device of Claim 17, wherein said Group III nitride layer and the Group III nitride regions are of net first conductivity type; and wherein the Group III nitride regions are more highly doped with first conductivity type dopants relative to said Group III nitride layer.

25. The device of Claim 24, wherein said Group III nitride layer and the Group III nitride regions comprise different concentrations of the same constituent Group III elements.

26. The device of Claim 25, wherein said Group III nitride layer comprises $Al_wIn_xGa_{1-w-x}N$ and the Group III nitride regions comprise $Al_yIn_zGa_{1-y-z}N$.

27. The device of Claim 17, wherein said Group III nitride layer and the Group III nitride regions comprise different concentrations of the same constituent Group III elements.

28. The device of Claim 27, wherein said Group III nitride layer comprises $Al_wIn_xGa_{1-w-x}N$ and the Group III nitride regions comprise $Al_yIn_zGa_{1-y-z}N$.

29. A semiconductor device, comprising:

a wide bandgap semiconductor layer having an array of discontinuous wide bandgap semiconductor regions therein that have wider bandgaps relative to said wide bandgap semiconductor layer and are doped at sufficient levels to increase an electrical conductivity of said first wide bandgap semiconductor layer relative to an otherwise equivalent wide bandgap semiconductor layer that is devoid of the array of discontinuous wide bandgap semiconductor regions.

30. The device of Claim 29, wherein the array of discontinuous wide bandgap semiconductor regions is a three-dimensional array.

31. The device of Claim 29, wherein said wide bandgap semiconductor layer has a plurality of two-dimensional arrays of discontinuous wide bandgap semiconductor regions therein that are parallel to each other.

32. The device of Claim 29, wherein the discontinuous wide bandgap semiconductor regions in the array are nonuniformly spaced from each other.

33. The device of Claim 29, wherein the discontinuous wide bandgap semiconductor regions in the array have nonuniform sizes and shapes.

34. The device of Claim 29, wherein said wide bandgap semiconductor layer has a plurality of two-dimensional regular arrays of discontinuous wide bandgap semiconductor regions therein that are parallel to each other.

35. The device of Claim 34, wherein the plurality of two-dimensional regular arrays of discontinuous wide bandgap semiconductor regions are staggered relative to each other.

36. The device of Claim 29, wherein said wide bandgap semiconductor layer and the wide bandgap semiconductor regions are of net first conductivity type; and wherein the wide bandgap semiconductor regions are more highly doped with first conductivity type dopants relative to said wide bandgap semiconductor layer.

37. A method of forming a semiconductor device, comprising:

growing a wide bandgap semiconductor layer having an array of discontinuous wide bandgap semiconductor regions therein that have a wider bandgap relative to said wide bandgap semiconductor layer, using growth parameters that alternate between those that favor growth of the wide bandgap semiconductor layer and those that favor growth of the wide bandgap semiconductor regions for a duration insufficient to support coalescing of the wide bandgap semiconductor regions.

38. A method of forming a semiconductor device, comprising:

growing a wide bandgap semiconductor layer of first material type having a plurality of discontinuous wide bandgap semiconductor regions of second material type therein that have a wider bandgap relative to the wide bandgap semiconductor layer, by:

(a) growing a wide bandgap layer of the first material type; then

(b) growing a wide bandgap layer of the second material type on the wide bandgap layer of the first material type; then

(c) patterning the wide bandgap layer of the second material type to define openings therein that expose portions of the wide bandgap layer of the first material type; and

(d) growing another layer of the wide bandgap layer of the first material type in the openings and on the patterned wide bandgap layer of the second material type; and

repeating steps (a), (b), (c) and (d) in sequence at least once.

39. A semiconductor diode, comprising:

a first wide bandgap semiconductor layer of first conductivity type having a first plurality of discontinuous wide bandgap semiconductor regions of first conductivity type therein that have a wider bandgap relative to said first wide bandgap semiconductor layer and contribute to an increase in conductivity of the first wide bandgap semiconductor layer by reducing an effective ionization energy of first conductivity type dopants therein; and

a second wide bandgap semiconductor layer of second conductivity type having a second plurality of discontinuous wide bandgap semiconductor regions of second conductivity type therein that have a wider bandgap relative to said second wide bandgap semiconductor layer and contribute to an increase in conductivity of the second wide bandgap semiconductor layer by reducing an effective ionization energy of second conductivity type dopants therein.

40. The semiconductor diode of Claim 39, further comprising a third semiconductor layer extending between said first and second wide bandgap semiconductor layers, said third semiconductor layer comprising a material having a bandgap that is less than a bandgap of said first wide bandgap semiconductor layer and less than a bandgap of said second wide bandgap semiconductor layer.